

**CHELSEA RIVER**  
**BOSTON HARBOR**  
**MASSACHUSETTS**  
**SURVEY**

(REVIEW OF REPORTS)

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND  
CORPS OF ENGINEERS  
WALTHAM, MASS.

October 10, 1960

## SYLLABUS

14162553 ✓

The Division Engineer finds that Chelsea River (Boston Harbor) is inadequate for the navigational needs of present and prospective shipping. He therefore recommends that the existing project be modified to provide for a channel 35 feet deep generally 225 to 250 feet wide below Chelsea Street Bridge, a channel 35 feet deep with widths varying from 250 to 430 feet above the Chelsea Street Bridge, and for inclusion of a turning and maneuvering basin of 800 feet average width and 1,000 feet average length, and 35 feet deep, all at an estimated cost of \$5,000,000 including local costs of \$2,140,000 for alteration of utilities and one wharf within the limits of the recommended improvement. He further recommends that those areas of the existing 30- and 8.4-foot channels, which lie outside of the channel and basin described above, be excluded from the Federal navigation project at this time. The estimated cost to the United States is \$2,843,000 for construction and \$2,500 annually for maintenance, in addition to that now required. The improvement, which will benefit commercial navigation, has a benefit-cost ratio of 4.0.

R/12/60

# TABLE OF CONTENTS

<u>PARAGRAPH</u> <u>NO.</u>	<u>SUBJECT</u>	<u>PAGE NO.</u>
1	Authority	1
3	Purpose and Extent of Study	1
4	Description of Navigation Conditions	2
8	Tributary Area	3
15	Bridges	4
17	Underwater Utilities	5
18	Prior Reports	6
19	Existing Corps of Engineers Project	7
23	Local Cooperation on Existing and Prior Projects	8
24	Other Improvements	8
27	Terminal and Transfer Facilities	9
30	Improvement Desired	12
41	Existing and Prospective Commerce	15
48	Difficulties Attending Navigation	18
49	Water Power and Other Special Subjects	18
50	Plan of Improvement	18
55	Shoreline Changes	20
56	Required Aids to Navigation	21
57	Estimate of First Cost	21
58	Estimates of Annual Charges	22
59	Benefits	24
64	Computation of Benefits	25
70	Comparison of Benefits to Cost	29
71	Proposed Local Cooperation	30
72	Coordination with Other Agencies	30
73	Discussion	30
82	Conclusion	33
83	Recommendation	34
APPENDIX A	Estimates of First Cost	A-1
APPENDIX B	U.S. Fish and Wildlife Report	B-1
APPENDIX C	City of Boston Comments	C-1
ATTACHMENT	Information, Senate Resolution 148	1

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND  
CORPS OF ENGINEERS  
424 TRAPELO ROAD  
WALTHAM 54, MASS.

10 October 1960

SUBJECT: Survey (Review of Reports) of Chelsea River (Boston Harbor, Massachusetts)

TO: Chief of Engineers, Department of the Army, Washington 25, D. C., ATTN: ENGOW-P

AUTHORITY

1. This report is submitted in compliance with the following resolution, adopted February 1, 1946, by the Committee on Rivers and Harbors of the House of Representatives, United States Congress:

"RESOLVED BY THE COMMITTEE ON RIVERS AND HARBORS OF THE HOUSE OF REPRESENTATIVES, UNITED STATES, That the Board of Engineers for Rivers and Harbors be, and is hereby, requested to review the reports on Chelsea River (Boston Harbor), Massachusetts, contained in Rivers and Harbors Committee Document Numbered 24, Seventy-fifth Congress, First Session, and prior reports, with a view to determining if it is advisable to modify the existing project at this time, particularly with reference to providing greater depth and increasing the clearances through existing bridges."

2. Pursuant to the above resolution, a preliminary examination report was submitted by the District Engineer August 12, 1946. The report, which was favorable, recommended a survey to determine the cost and the extent of any improvements which may be found to be justified. The report of the Board of Engineers for Rivers and Harbors being favorable, the recommended survey was assigned to the Division Engineer, New England, by letter from the Chief of Engineers dated October 18, 1946.

PURPOSE AND EXTENT OF STUDY

3. This study was made to determine the feasibility and economic justification of deepening and widening the waterway to accommodate the larger vessels currently being used in coastwise petroleum transportation. Increased bridge clearances are no longer part of the study. A new bridge (P. J. McArdle) has been erected, and a new fender system at another (Chelsea Street) will give horizontal clearance for present and prospective commerce. For preparation of this report a detailed hydrographic survey was made. The survey included soundings and

probings to determine the quantity and nature of materials to be removed by dredging. Available maps, commercial statistics and aerial photographs have been studied and evaluated. A public hearing was held on June 26, 1946 at the United States Post Office Building, Boston, Massachusetts. The information obtained at the hearing has been considered in the report. Supplementary information and data, obtained from local, shipping, and petroleum interests, have also been considered. Contacts with local, municipal, and harbor interests have been made throughout the entire period of the study.

#### DESCRIPTION OF NAVIGATION CONDITIONS

4. Chelsea River rises in the city of Revere, Massachusetts, and flows in a southerly and westerly direction for a distance of 4.5 miles. It empties into Boston Harbor from the eastward at the P. J. McArdle Bridge (former Meridian Street Bridge) between East Boston and Chelsea, Massachusetts. From its mouth to Slade's Spice Mill dam, a distance of about 2.2 miles, the river is tidal. Above the dam it is a surface drainage brook, extending inland through a densely populated area. The head of commercial navigation is just below the Boston & Maine Railroad fixed bridge, about 700 feet below the dam. United States harbor lines have been established from the mouth of the river to the dam at Slade's Spice Mill. The width between harbor lines from the mouth of the river to the Chelsea Street Bridge varies from 450 to 300 feet; above Chelsea Street Bridge the width between harbor lines is generally about 500 feet, narrowing to 300 feet at the Boston & Maine Railroad bridge.

5. A controlling depth of 29.2 feet at mean low water (1958) exists from the mouth to the Chelsea Street Bridge, 28.4 to a point abreast of the Hartol Products Corp. terminal, thence, 8 feet (1936) to the bend just below the head of navigation. Beyond this point the river shoals to about mean low water at the Boston & Maine Railroad fixed bridge.

6. The approach to Chelsea River is through the 40-foot channels of Boston Harbor from President Roads to the vicinity of Mystic State Pier, Charlestown, and thence through a 35-foot channel to the mouth of Chelsea River. Directly opposite the mouth of Chelsea River is the Mystic River, emptying into Boston Harbor from the westward, with a controlling depth of 35 feet to a point 2,750 feet upstream of the easterly end of the Esso Wharf.

7. The mean range of tide is 9.6 feet and the spring range is 11.0 feet. The locality is shown on U. S. Coast and Geodetic Survey Charts Nos. 246 and 248 and on the maps accompanying this report.

## TRIBUTARY AREA

8. The East Boston section of Boston and the cities of Chelsea and Revere border the river, East Boston and Revere on the southerly shore, and Chelsea on the north. In 1950, the populations were Boston, 788,554; Chelsea, 39,038; and Revere, 36,663.

9. Chelsea is a city of many diversified industries, the most important of which are storage and distribution of petroleum, shoe manufacturing, printing, textiles, food products, foundry and machine shops, mill working, chemicals, woodworking and paper-box board. Its real estate valuation was \$46,441,609 in 1950.

10. The industries located along the Chelsea waterfront of the Chelsea River are Eastern Minerals Co., Atwater Fuel Co., Hersey Construction Co., six oil companies (namely, Quincy, Texas, Jenney, American Oil Co. (Mexican Petroleum Corp.), Gulf Oil Corporation, (Northeast Petroleum Corporation), and the Forbes Lithograph Co.

11. Revere is primarily a residential city, but it has a few large industries, including the National Fireproofing Co., a cotton waste plant, and five oil companies (the Tide Water Oil Co., Union Oil Co., Atlantic Refining Co., Sun Oil Co., and the Hartol Products Corp.). The oil companies are located along the Revere waterfront of Chelsea River.

12. The East Boston section of Boston is thickly populated. Its northern boundary is Chelsea River, along which are located the plants of dredging and wharf-building contractors, the State Fuel Co., the Boston Sand & Gravel Co., and the Socony-Mobil Oil Co. Boston Harbor's main waterfront is the boundary for East Boston on its westerly and southerly sides.

13. The oil companies listed above have facilities for the receipt and storage of petroleum products, principally gasoline and fuel oil. These products are distributed over a large area surrounding Boston.

14. The area is served by excellent highways and streets. The Boston & Maine Railroad is adjacent to both shores of the upper half of the river, which it parallels, its main line serving the north shore of the upper portion of the river and crossing the river above the head of navigation, and a branch line serving the south shore of the upper river. The New York Central Railroad, through its subsidiary Boston and Albany Railroad, serves the Cunard piers on the main waterfront of Boston Harbor. Its connection to East Boston is over tracks of the Boston & Maine Railroad described above. The Logan Airport is located in East Boston. Regularly scheduled commercial plane service to all parts of the world may be obtained from this airport.

## BRIDGES

15. Three bridges, the main features of which are tabulated below, span Chelsea River. The first two cross the river from East Boston to Chelsea and the third from Revere to Chelsea, above the head of navigation.

	:	:	:	:	:	:	Plans :	
Name	:Miles:	:	Clearance in Feet	:	:	:	Apvd.by:	Date
&	:Above:	:	Hori- : Vertical	:	:	:	War :	Com-
Use	:Mouth: Type	:	zontal:M.L.W.:M.H.W.:	:	:	:	Owner: Dept. :	pleted
	:	:	:	:	:	:	:	:
P.J.McArdle	: 0.2	:Double	:175	:30.5	:20.7	:	City : May	: Aug.
Bridge	:	:Leaf	:	:	:	:	of : 31,	: 22,
(Highway)	:	:Bascule:	:	:	:	:	Boston: 1946	: 1954
	:	:	:	:	:	:	:	:
Chelsea St.	: 1.2	:Bascule:	:96 <sup>(1)</sup>	:19	: 9.4	:	City : Dec.	: July
Bridge	:	:	:	:	:	:	of : 19,	: 1,
(Highway)	:	:	:	:	:	:	Boston: 1935	: 1937
	:	:	:	:	:	:	:	:
Boston and	: 2.6	: Fixed	: 10.5	:14.2	: 4.6	:	B & M: -	: -
Maine	:	:	:	:	:	:	RR. :	:
(Railroad)	:	:	:	:	:	:	:	:

- (1) Bids were received in August 1960 for removal and reconstruction of fender on Chelsea side of river. Pending completion of fender reconstruction, old fender limits horizontal clearance to 70 feet.

16. A fourth bridge, the Grand Junction railroad bridge, formerly crossed the waterway just above the Chelsea Street Bridge. It was a single leaf bascule bridge, with a draw span of 70 feet. Serious difficulty was encountered in the navigation of 68-foot wide T-2 tankers through this opening and passage of larger tankers was impossible. The oil companies, located in the upper reach, requested alterations to the bridge to provide for a wider draw-span. The railroad was reluctant to make any change. On February 28, 1955, the bridge collapsed, closing the river temporarily to navigation. All sections intruding on the channel were removed, and through agreement with the Boston & Maine Railroad the New York Central now routes its trains around the head of navigation. The New York Central Railroad has secured Interstate Commerce Commission approval for permanent relocation of its rail connection to East Boston in the fashion described above, thus obviating any further need of future bridge construction.

## UNDERWATER UTILITIES

17. Several underwater utilities, both municipal and commercial, cross the navigable section of Chelsea River considered in this report. Pertinent data and descriptions are contained in the following subparagraphs:

a. A water supply tunnel, located about 0.1 mile above the mouth of the river, crosses from East Boston to Chelsea. Elevation of the top of the tunnel on the East Boston side is 38.5 below mean low water and 39.6 on the Chelsea side. Deepening to 35 feet will not affect this tunnel.

b. Seven submarine cables cross the waterway about 0.3 mile above the mouth. These cables are buried at an elevation of 45 feet below mean low water and cross from East Boston to Chelsea. Six of the cables are owned by the New England Telephone and Telegraph Company and one by the City of Boston Fire Department. Deepening to 35 feet will not affect these cables.

c. About 235 feet downstream of the Chelsea Street Bridge there are located nine submarine cables which are buried at an elevation of 45 feet below mean low water between points 35 feet outside either channel limit. Two cables are owned by the Metropolitan Transit Authority and seven by the Boston Edison Company. Realignment of channel limits and deepening to 35 feet will not affect these cables.

d. A Boston Edison single cable lies about 190 feet downstream of the Chelsea Street Bridge. This cable is buried 40 feet below mean low water between the existing channel limits. Channel deepening will not affect this cable.

e. A water supply tunnel owned by the Metropolitan District Commission is located about 150 feet downstream of the Chelsea Street Bridge. The top of the tunnel is 35.14 feet below mean low water. The Commission has been advised of the proposed 35-foot deepening and has stated that it would prefer to consider the advisability of having the tunnel remain in its present position, assuming all liability for damages that may occur during construction or thereafter. If lowering the tunnel is required, the estimate of cost to be incurred would amount to \$1,000,000.

f. A large sewer siphon of the Metropolitan District Commission is located about 100 feet below the Chelsea Street Bridge. Its top elevation is 50.78 feet below mean low water. Deepening will not affect this installation.



g. The Boston Consolidated Gas Company's gas siphon is located about 50 feet below the Chelsea Street bridge at an elevation of 33.6 feet below mean low water. This utility will have to be lowered by the owner in event of improvement. An estimate of the cost of alteration, furnished by the owner is \$910,000 (1959).

h. The Metropolitan District Commission owns a sewer siphon crossing between the fenders of the Chelsea Street Bridge. Top of the siphon is 31 feet below mean low water. It has been filled in and abandoned.

i. Power cables for operation of the P. J. McArdle Bridge at the river mouth are laid in a trench between fenders, 45 feet below mean low water. Channel improvement will not affect this installation.

j. The New York Central Railroad owns a cable laid directly on the river bottom on the line of its previous bridge crossing. This cable has not been abandoned. It will require lowering in the event of improvement, and is estimated to cost \$8,000 for lowering.

k. The Metropolitan Transit Authority has four cables crossing the river at a depth of 32 feet. These cables are located just downstream of the Chelsea Street Bridge. Lowering of the cables is estimated to cost \$8,000.

#### PRIOR REPORTS

18. The following tabulation lists the essential features of the reports on Chelsea River previously submitted:

<u>Doc.</u>	<u>Auth.</u>	<u>Type of Report</u>	<u>Improvement Considered</u>	<u>Recommendation of the Chief of Engineers</u>	<u>Action by Congress</u>
H.Ex.Doc. No. 40, 52d Cong., 2d sess.	R&H Act July 13, 1892	Prelim. Exam.	Improvement of Chelsea River from Grand Junction RR Bridge to Boston & Maine (Eastern Division) Rail- road Bridge.	Favorable	Authorized a survey R&H Act Aug. 17, 1894

Doc.	Auth.	Type of Report	Improvement Considered	Recommendation of the Chief of Engineers	Action by Congress
H.Ex.Doc. No. 162, 53d Cong., 3d sess.	R&H Act Aug. 17, 1894	Survey	Channel 18' deep at mean <u>high</u> water, 150' wide from 2000' above the Grand Junction RR Bridge to the head of navigation B&M (Eastern Division) Railroad Bridge.	Favorable	Adopted by R&H Act June 3, 1896
H. Doc. No. 272, 62d Cong., 2d sess.	R&H Act June 25, 1910	Prelim. Exam. & Survey	Channel 25' deep at mean low water, 150' wide from the P. J. McArdle Bridge to the old East Boston (Chelsea Street) Bridge.	Favorable	Adopted by R&H Act July 25, 1912
H. Doc. No. 24, 75th Cong., 1st sess.	R&H Comm. Resolu- tion Jan. 14, 1936	Survey	Channel 30' deep at mean low water, 200' wide from the mouth to a point abreast of the Hartol Products Corp.	Favorable	Adopted by R&H Act Aug. 26, 1937

#### EXISTING CORPS OF ENGINEERS PROJECT

19. Chelsea River is part of the existing project for Boston Harbor. The original improvement of the waterway was authorized by the River and Harbor Act of June 3, 1896. It consisted of improvement of the channel above the former Grand Junction Railroad Bridge. The project provided for a channel 18 feet deep at mean high water (8.4 feet at mean low water) and 150 feet wide beginning about 2,000 feet above the railroad bridge and extending to a line immediately downstream of the Boston and Maine fixed railroad bridge, a distance of about 1 mile. The project was completed during the fiscal year 1907 at a cost of \$73,071.49.

20. A project for improving the river from the former Meridian Street Bridge (now known as the P. J. McArdle Bridge), at the head of the 35-foot channel in Boston Harbor, to the old East Boston (Chelsea St.) Bridge was adopted by the River and Harbor Act of July 25, 1912. The project provided for a channel 150 feet wide and 25 feet deep at

mean low water. All work under this project was completed in fiscal year 1916 at a cost of \$33,810.89. Maintenance costs to 1916 amounted to \$17,881.01.

21. The existing project provides for a channel in Chelsea River 30 feet deep and generally 200 feet wide, with increased width at the bends from the mouth of the river, at the head of the 35-foot channel in Boston Harbor, to a line opposite the Hartol Products Corp. terminal, thence 8.4 feet deep and 150 feet wide to a line immediately below the Boston and Maine Railroad (Eastern Division) Bridge at the head of navigation. The project was completed during fiscal year 1940, except for an area in the vicinity of the Metropolitan District sewer siphon immediately below the Chelsea Street Bridge. This area was completed during the fiscal year 1946. The expenditures for new work under the existing project were \$530,277.74. Maintenance dredging was accomplished in 1953 at a cost of \$112,748. There is no approved estimate for Chelsea River, which is included as part of the Boston Harbor project. The latest approved (1955) estimate of annual maintenance for Boston Harbor is \$154,700. The estimate for additional annual maintenance of the 30-foot project for Chelsea River recommended in the project document in 1937 was \$6,000.

22. The expenditures for all improvements since the adoption of the original project are \$637,160.12 for new work and \$130,629.41 for maintenance.

#### LOCAL COOPERATION ON EXISTING AND PRIOR PROJECTS

23. The present 30-foot channel was adopted by the River and Harbor Act of August 26, 1937 subject to the provision that the Commonwealth of Massachusetts lower the sewer siphon which crossed the river immediately below the Chelsea Street Bridge. Compliance with this provision was effected by the Commonwealth of Massachusetts in 1946.

#### OTHER IMPROVEMENTS

24. The Commonwealth of Massachusetts expended \$60,850 for extending the 25-foot Federal channel from the Chelsea Street Bridge to the American Oil Co. (Mexican Petroleum Corp.) plant, and \$135,000 for the removal of old wrecks from the shores of the river below the Chelsea Street Bridge.

25. The Boston Port Development Co. expended \$412,000 for extending the 25-foot channel from a point near the Gulf Oil Corp. wharf to the Tide Water and Hartol oil wharves, together with dredging a turning basin 25 feet deep at the oil wharves.

26. The total of the above expenditures amounts to \$607,850 resulting in an extension of the Federal 25-foot channel upstream for a distance of about 1 mile, the removal of abandoned hulks, and the provision of a turning basin.

#### TERMINAL AND TRANSFER FACILITIES

27. On Chelsea River between the mouth and Chelsea Street bridge the most important terminals are as follows:

a. The State Fuel Co. terminal is located on the left bank in East Boston about 3300 feet above the mouth of the river. This terminal is used for the receipt, storage and distribution of petroleum products. The terminal has 300 feet of berthing space with a depth of 32 feet. There is one 8-inch and one 6-inch pipeline for discharging tankers. The pipelines connect with 12 steel storage tanks in the rear of the wharf with a capacity of 300,000 barrels. The wharf is not open to public use.

b. The Socony-Mobil Oil Co. terminal is located on the left bank, adjacent to the Chelsea Street bridge. This wharf has a frontage of 1,177 feet and a depth of 31 feet. Oil tankers 617 feet in length and drawing 33.5 feet of water dock at this wharf. It is used for the receipt, storage, distribution of petroleum products and bunkering of small vessels. Four 12-inch, two 10-inch, one 8-inch, fifty-five 6-inch, and five 4-inch pipelines extend to 70 storage tanks in the rear of the wharf. The total capacity of the tanks is about a million barrels. There is one 3-inch diesel line for bunkering. This terminal has excellent highway and railroad facilities. It is not open to public use.

c. The Jenney Oil Co. terminal is located on the right bank just below the Chelsea Street bridge. Usable berthing space at this wharf is 725 feet, of which 605 have a depth of 31 feet. This terminal is used for the receipt, storage, distribution of petroleum products, and bunkering of vessels. Five 12-inch, one 10-inch, one 8-inch and six 6-inch pipelines extend to 21 steel storage tanks in the rear of the wharf. These tanks have a total capacity of 376,900 barrels. It has excellent highway and railroad facilities. It is not open to public use. The company is presently planning to expand this terminal.

d. The Texas Oil Co. terminal is located on the right bank about 2100 feet above the mouth of the river. It has an available frontage of about 800 feet. Until 1958 this was a small local terminal with a total capacity of 35,240 barrels. The terminal was altered during 1958. It now has a storage capacity in 7 tanks of 277,290 barrels and a pile and timber wharf 800 feet long. The berthing space has been dredged to 35 feet for its entire length.

and 20,000-ton tankers now deliver oil to this terminal. It has excellent highway and railroad connections. The wharf is not open to public use.

e. The Quincy Oil Company terminal is located on the right bank of the river just below the Texas Oil Company. It has a frontage of about 210 feet. There is a small pier which has a berth 90 feet long and 11 feet deep. This terminal is used for the receipt, storage, distribution of petroleum products, and bunkering of vessels. Small motor barges dock at this wharf. There is one 6-inch and one 4-inch pipeline extending to 8 steel storage tanks in the rear of the wharf. These tanks have a total capacity of 20,000 barrels. There are excellent highway connections but no railroad facilities. The wharf is not open to public use.

f. In addition to the above-mentioned terminals, there are several smaller wharves used by dredging companies, wharf builders, a boat service company, and a mineral spirits concern, with facilities adequate for their needs. These wharves are not open to public use.

28. Above the Chelsea Street Bridge, the most important terminals are as follows:

a. The American Oil Co. (Mexican Petroleum Corp.) terminal is located on the right bank just above the Chelsea Street Bridge. This terminal is used for the receipt, storage, and distribution of petroleum products. The wharf is a stone and timber bulkhead with mooring dolphins and has a usable berthing space of 990 feet, 32 feet deep. One 6-inch, two 10-inch and four 8-inch pipelines extend to 15 steel storage tanks with a total storage capacity of 602,500 barrels. It has excellent railroad and highway connections. It is not open to public use.

b. The Gulf Oil Corporation has a modern oil terminal on the property formerly owned by the Ipamco Pipe Corporation. It is located on the right bank of the river immediately above the American Oil Company terminal. The present storage capacity of the terminal is 1,100,000 barrels. The wharf used in connection with this facility is a pile and timber marginal structure with a total berthing length of 620 feet, of which 550 feet is dredged to 31 feet. There is no railroad connection to the terminal. The wharf is not open to public use.

c. The Northeast Petroleum Corporation in 1959, completed a new terminal immediately above the Gulf Oil terminal. It is a modern oil terminal having a storage capacity of 300,000 barrels in 4 tanks. Wharfage facilities consist of a 30-x 40-foot pile and timber pier with 14- x 14-foot mooring end dolphins spaced 720' apart.

Intermediate dolphins are placed between the end dolphins and connected to each other by means of a 3-foot catwalk. Berthing space of 720' has been dredged to 32 feet. This wharf lies within the recommended relocation of harbor lines and will require relocation in the event of improvement. Estimated cost of relocation is \$214,000.

d. The Union Oil Products Co. terminal is located approximately one mile above the Chelsea Street Bridge on the left bank of the river. It has 1150 feet of available berthing space at a depth of 30 feet. There are two 12-inch and one 10-inch pipelines connecting to 10 steel storage tanks located in the rear of the pier. Total capacity of tanks is 761,900 barrels. There are excellent highway and railroad facilities. The wharf is not open to public use.

e. The Sun Oil Company terminal is located south of and adjacent to the Union Oil Products Co. Wharfage for this company is provided through a leasing arrangement with Atlantic Coast Terminals Inc. which allocates a section of its wharf for the receipt of the Sun Oil Company's petroleum products. Two 8-inch pipelines connect to the terminal from the wharf. The terminal has a storage capacity of 105,000 barrels. This terminal has highway and railroad facilities. It is not open to public use.

f. The Hartol Products Corp. terminal is located adjacent to and just south of the Sun Oil Company terminal and has similar facilities for the receipt, storage, and distribution of petroleum products. This terminal has a pile and timber wharf 575 feet long with an adjacent berth dredged to 32 feet for a length of 610 feet. Tankers are discharged by pipelines running from the wharf to 6 storage tanks which have a storage capacity of 310,000 barrels. The terminal has highway and railroad connections. The wharf is not open to public use.

g. The Atlantic Refining Company has an oil terminal adjacent to and south of the Hartol Products Corp. This company has extended the existing wharf of the Tidewater Associated Oil Company and under leasing agreement uses this extension for the receipt of its petroleum products. Four 12-inch pipelines connect the wharf to the terminal. The present storage capacity of the terminal is 480,000 barrels. It has railroad and highway connections and is not open to public use.

h. The Tidewater Associated Oil Co. terminal is located on the east bank of the river just below the Atlantic Refining Co. This terminal, which is used for the receipt, storage, and distribution of petroleum products, has 750 feet of berthing space on its lower side, with depths ranging from 10 to 40 feet, and 75 feet of

berth on its upper side with depths ranging from 45 to 10 feet. The wharf is equipped with pipelines for discharging tankers and has excellent highway and railroad connections. The storage capacity is 480,000 barrels. It is not open to public use.

i. The Metropolitan terminal operated by the Metropolitan District Commission is on the left bank of the river above and adjacent to the Chelsea Street Bridge. The wharf is used for the receipt of coal for operation of a sewer pumping station. It has about 100 feet of available berthing space with a depth of 5 feet.

29. There are no piers on Chelsea River under municipal or public control which are open to the public.

#### IMPROVEMENT DESIRED

30. In order to afford local interests an opportunity to express their views relative to the improvement of Chelsea River, a public hearing was held at the United States Post Office Building, Boston, Massachusetts on June 26, 1946. The hearing was well attended. Among those present were representatives of the State Planning Board of the Commonwealth of Massachusetts, Public Works Department of the City of Boston, the Maritime Association of the Boston Chamber of Commerce, the American Merchant Marine Institute, the Boston Elevated Railway, the Boston Consolidated Gas Co., the Boston Edison Co., the New England Telephone & Telegraph Co., the National Bulk Carriers Association of the American Transport Corp., oil interests, towboat companies, and several railroads. The report on preliminary examination, together with a transcript of the hearing, the exhibits presented, a map, and other pertinent papers was submitted August 12, 1946.

31. The improvements desired are: a 35-foot deep channel in lieu of the existing 30-foot channel, an increase in channel width throughout where possible, particularly at the bends, and the provision of a turning basin 35 feet deep at the upper end of the channel.

32. The chief advocates of improvement are the oil interests. They are unanimous in their opinion of the improvements desired and the necessity thereof. The American Merchant Marine Institute presented a detailed statement of the present conditions together with their estimate of the probable future commerce and benefits resulting from improvement. This statement was submitted by the Institute as representative of the majority of American Flag Shipping. Thus it represents practically all the shipping that utilizes Chelsea River.

33. The Institute stated that, under conditions prevalent at that time, inadequate channel depth and limited bridge clearances made navigation in the river hazardous for T-2 Tankers and impossible for vessels of deeper draft. These conditions restricted loaded inbound ships to a two-to four-hour period of navigation in daylight hours, and outbound light ships to daylight hours, resulting in an average delay of about 10 hours per vessel per round trip. Results of a survey relative to anticipated receipts of petroleum products in the waterway were also carried in the statement. A total volume of 5,500,000 tons, representing over 300 T-2 tanker trips was predicted for the year 1960.

34. Direct and indirect benefits resulting from the desired improvement were set forth by the Institute. The direct benefits were based on savings effected by reduction in tidal delays, towboat assistance in the narrow constructed waterway, accidents, and groundings. The reduction in tidal delays for the predicted 300 T-2 round trips in 1960 would result in savings of \$360,000; the reduction in towboat assistance for the same year would result in savings of \$45,000, and the reduction in accidents and groundings would amount to \$5,000. Total benefits thus claimed were estimated at \$410,000 annually by 1960. Indirect benefits claimed and for which no monetary evaluation was made, consisted of; development of the waterfront in the upper reach, more complete utilization of the larger and more economical ships, and more efficient and economical distribution of petroleum products in the tributary area.

35. The conclusions reached by the statement are summarized below:

a. The waterfront adjacent to the Chelsea River channel offers the only available space in Boston Harbor for the efficient expansion of oil terminal facilities.

b. In the future, practically all petroleum products will be carried in tankers of the T-2 or larger classes.

c. The existing project for Chelsea River channel is inadequate and unsafe for the class of tankers which will be used.

d. Unless Chelsea River is improved great hardship and loss will ensue to petroleum consumers and the petroleum industry in the Boston Area.

e. Benefits resulting from the improvement recommended would amply justify the cost of the work.



36. On 16 October 1956 the Institute submitted a statement supplementing the data it submitted at the public hearing. This statement cited the resolution of the former problem concerning the old Meridian Street Bridge (now the new P. J. McArdle Bridge) and the imminent resolution of the Grand Junction Railroad Bridge, which collapsed in 1955. It reiterated the necessity of deepening the channel to 35 feet with provision for a turning basin 35 feet deep at the upper end of the project. The 35-foot channel depth was predicated on the full load draft of the ship, plus allowances for scend, squat, uneven loading of ships and an allowance of 2-3 feet required for navigation control. Necessity for deepening the waterway was based on the recent trend to larger tanker construction and the inadequacy of channels designed for T-2 tankers of 16,500 deadweight tons capacity. The statement further declared that a 35-foot channel will be necessary for the 20,000 ton and larger tankers soon to move to the terminals in the area. Tankers of these types, it was estimated, would carry a load of about 5,500,000 tons in 1965. It was also estimated that the use of these tankers would result in savings in transportation costs of about \$0.08 per barrel or about \$0.60 per cargo ton. Benefits resulting from these savings are predicted to total \$1,364,000 annually by 1965.

37. Various oil companies filed statements containing arguments and conclusions similar to those outlined above. The Gulf Oil Corp., now located on Chelsea River, stated that property had recently been acquired there and construction of terminal facilities costing about \$2,000,000 would be made. This terminal has been constructed, is now operative, and received about 700,000 tons of petroleum products in 1958.

38. The Commissioner of Public Works, City of Boston, presented information concerning bridges owned by the City of Boston. He indicated that, subject to the provisions that the structures are not damaged, he was in favor of the project.

39. A representative of the Boston Consolidated Gas Co. cited the fact that a gas siphon which provides the only gas supply to East Boston passes under the river at a depth of 33 feet and the proposed improvement would require a tunnel being driven from the East Boston side to the Chelsea side.

40. No offer of a cash contribution was made by any of the proponents. The brief filed by the Maritime Association of the Boston Chamber of Commerce contained the following statement which is believed representative of the opinion of the other advocates of the improvement: "In view of the large amounts already expended by the Boston Port Development Company; the Commonwealth of Massachusetts; and the oil companies above the bridges for the improvement of Chelsea River navigation, your petitioner submits that no further local cash contribution should be sought or expected. Moreover, your petitioner asserts that the expenditures mentioned are considerably in excess of local contributions usually forthcoming in other localities for similar projects."

#### EXISTING AND PROSPECTIVE COMMERCE

41. The principal items of commerce in Chelsea River are petroleum and petroleum products. Such commerce in 1958 amounted to 5,373,000 tons or 99.7 percent of all traffic on the waterway. It also represents about 39 percent of all such commerce in the Port of Boston. The waterway is a receiving port, as 89 percent of its commerce was delivered to the 12 terminals on the waterway existing in 1958. This commerce is delivered chiefly in T-2 or larger vessels in the lower reach and T-2 or smaller vessels in the reach above the Chelsea Street Bridge. The former bridge restriction of 70 feet horizontal clearance precluded passage of larger ships. In recent years a considerable portion of the commerce was delivered in barges and motor vessels carrying about 2,000 tons maximum. Local interests claim that this became necessary, as T-2 tankers are rapidly being retired and the restricted waterway would not permit the use of larger vessels, particularly in the upper reach.

42. The area in the vicinity of the waterway is one of few areas in Boston Harbor available for expansion of the petroleum industry. Several recent surveys have been made by prospective terminal operators, who have indicated an interest in refurbishing some of the unused wharves with a

view to establishing new oil terminals. To some extent the inadequacy of the waterway for deep draft vessels has deterred further consideration of the locality as a terminal. Several of the present terminal operators have declared their intention of enlarging their facilities should improvement be made.

43. During the years 1958 and 1959 one additional terminal, the Northeast Petroleum Corporation, was constructed in the upper reach. In the same years one small terminal, owned by Texas Co., in the lower reach enlarged its storage capacity and altered its wharfage facilities to receive vessels of the 20,000 to 30,000 ton class. The Northeast Petroleum terminal in the upper reach has recently been placed in operation and estimates a volume of about 400,000 tons for its first year of operation. This terminal being in the upper reach, is presently restricted to T-2 vessels. The enlarged terminal in the lower reach estimated that its commerce in the first full year would be about 400,000 tons. The increase attributable to these terminals alone represents an increase of 8 percent over the 1958 commerce.

44. Petroleum commerce has increased steadily in the waterway. Over the past decade the commerce has increased from 4,240,000 tons to 5,373,000 tons, about 27 percent. The increase is attributable partly to increased consumption of petroleum and partly to the location of the waterway. Its location in the port of Boston is the site of the greatest concentration of oil terminals, and there is available area for expansion. Therefore it is considered that the major portion of any future expansion of the oil industry in the port will be located on the waterway.

45. In view of the above described conditions and statistical data on future demands, it is estimated that petroleum commerce on the waterway will have increased by 60 percent in 20 years, and will remain relatively stable after that time. This consideration is based on the capability of the waterway to handle such commerce at that time and the future utilization of all areas now available for expansion.

46. A detailed statement of commerce in 1958, the latest year for which such statistics are available, is shown below:

TABLE I

Commodity	Total	Foreign	Domestic				
		Imports	Coastwise		Intraport		Local
			Receipts	Shipments	Receipts	Shipments	
Bituminous Coal and Lignite	5,952				5,952		
Gasoline	1,906,845		1,713,656	91,813	6,112	39,520	55,744
Gas Oil Distillate Fuel Oil	2,467,271		2,211,452	59,027	71,286	106,798	15,168
Petroleum, Crude	33,616		33,616				
Kerosene	373,285		323,752	18,388	11,981	7,698	8,466
Residual Fuel Oil	523,510	116,312	359,843	15,356	1,885	30,007	107
Petroleum Asphalt	7,697		2,362			5,335	
Lubricating Oils and Greases	14,364		13,545			819	
Petroleum Products nec	45,734		45,734				
Salt	3,136	3,136					
Coal Tar Products	7,071		1,190	4,932	949		
Medicines & Preparations	146		146				
Commodities nec	4						
Water	2,300						
Total	5,390,931	119,448	4,708,296	189,516	104,009	190,177	79,485
Total Ton Miles	8,086,397						

## VESSEL TRAFFIC(inbound and outbound)

47. Trips and drafts of vessels in the latest 10-year period are tabulated below:

	Draft	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958
35									1	2	
34							4	3	4	10	15
33							2	1	2	1	13
32	3	8	4	3	4	4	4	5	5	7	4
31	32	90	103	71	82	83	105	108	109	109	110
30	80	85	89	102	103	94	95	109	78	99	
29	51	22	27	24	28	24	22	18	10	5	
28	52	20	17	24	8	8	7	6	6	3	
27	17	11	11	4	2	5	8	4	8	6	
26	-	9	12	11	11	9	11	5	4	6	
25	8	32	5	2	7	11	8	8	15	15	
Total 25' & Over	243	283	268	211	245	214	265	270	250	286	
Under 25'	13,625	10,275	11,972	12,039	8,471	6,134	5,111	2,396	2,308	4,112	
Total	13,868	10,558	12,240	12,280	8,716	6,378	5,406	2,666	2,058	4,398	

As indicated in the above table the trend of vessel traffic is toward deeper-draft vessels. The trips of vessels over 31-foot draft have all been made in the lower reach of the river. Should improvement be made it is considered that the major portion of all receipts will be delivered in ships with drafts of 31 feet or deeper.

#### DIFFICULTIES ATTENDING NAVIGATION

48. Navigation for deep draft vessels is limited to periods of favorable tides. The major portion of deep draft vessels now using the waterway are tankers of the T-2 class and super-tankers. T-2 tankers drawing slightly in excess of thirty feet, and supertankers of 30-to 34-foot draft are forced to wait for enough tide to insure adequate clearance between the keel of the ship and the channel bottom. A five-foot clearance is generally accepted as minimum. Thus the vessels wait for 5-foot or higher tides. Difficulty is also encountered in navigating the bends, in the maneuvering of vessels prior to docking at the wharves in the upper end, and in turning around to proceed out-bound after discharging cargo. Navigation of the upper reach above Chelsea Street Bridge is not feasible for vessels larger than T-2 tankers.

#### WATER POWER AND OTHER SPECIAL SUBJECTS

49. There are no matters of flood control or water power pertinent to this report. The channel improvement considered in this report would not have an adverse effect on either pollution, irrigation, recreation or fish and wildlife.

#### PLAN OF IMPROVEMENT

50. The considered plan of improvement, developed by this study, agrees substantially with the desires of local interests, with the exception of the horizontal clearance of the Chelsea Street Bridge.

Local interests requested a 100-foot horizontal clearance in lieu of the 96-foot clearance considered. As stated previously, the former clearance between fenders was 70 feet. With the collapse of the former railroad bridge studies were made of the possibilities of providing a 100-foot width through the highway bridge. Shipping interests were consulted. These interests stated that the maximum width of future vessels would be 90 feet. It was further stated that any width in excess of 95 feet would be acceptable, despite the seemingly close tolerance of 2.5 feet on either side. In support of this statement they cited the condition prevalent in the 70-foot width when 68-foot wide tankers were taken through with only 1-foot tolerance on either side. The City of Boston was adverse to any plan of improvement which would entail modification or reconstruction of the highway bridge. It was maintained that the bottoms of the channel-pier footings were not deep enough to permit excavation of a 35-foot channel depth for the full draw-width between the bridge piers, and that any such excavation would tend to set up unequal lateral forces on the piers. The in-balance of the lateral forces could result in horizontal displacement of the piers and a resultant collapse of the entire structure. Studies were

made of various methods of widening and deepening which would obviate danger to the piers. A plan was evolved whereby, for the purpose of equalizing the lateral forces, dredging shoreward of piers would be accomplished in conjunction with channel deepening. This plan allowed for dredging a channel to 35 feet for a bottom width of 85 feet, with 1 on 2 slopes, and placing the East Boston fender on the slopes so that a horizontal water surface clearance of 96 feet could be obtained. Shipping interests agreed that this plan was the maximum possible improvement that could be obtained under existing conditions. Any improvement, short of rebuilding the bridge, will include a channel limitation consistent with this plan.

51. A 35-foot channel depth was selected as the most feasible depth for the needs of current and anticipated commerce. Studies of 34-foot and 37-foot depth channels were made also. It was found that the 34-foot channel would not entirely eliminate tidal delays for the present commerce and would be inadequate for larger vessels. The 37-foot channel would eliminate tidal delays for vessels drawing up to 32 feet but benefits to be derived from the incremental difference of the 2-foot deepening between 35 and 37 feet were found to be insufficient to justify the estimated additional cost of \$650,000 for deepening. The 35-foot channel design criteria was based on reduction of tidal delays for all ships in excess of 25-foot draft, including T-2 tankers drawing 30 feet and larger tankers drawing 31 to 34 feet. For all vessels traversing the waterway, it is estimated that a 5-foot clearance between the hull and the channel bottom is necessary. The 5-foot clearance includes a factor of 1 to 2 feet for uneven loading, 1 foot for sinkage in a constricted channel, and 2 to 3 feet for rudder workability and propellor clearance. The sinkage factor for relatively low speeds, such as employed in Chelsea River, is minor in open water. In constricted channels where the ratio of the cross sectional area of the waterway to the cross sectional area of the hull is less than 4 to 1, the increase in sinkage is marked, approaching a value of 1 foot as the areas tend to equalize. In Chelsea River, in the most constricted part of the channel with ships alongside of abutting docks, the ratio is 1.6 at low water in the 30-foot channel and 3.5 in the proposed 35-foot channel for T-2 Tankers, with smaller values for larger tankers. Therefore a sinkage allowance of 1 foot was considered necessary, in determination of hull clearance. With an allowance of 1 to 2-feet for uneven loading and the 1-foot allowance for sinkage, the hull of a 30-foot registered draft ship, moving at normal speed in the waterway, would extend 32 to 33 feet below the water surface. Some clearance between the hull and the channel bottom is necessary to avoid grounding or sucking of the channel bottom materials into the propellor bearing, and to afford sufficient clearance for adequate rudder action and propellor workability. The commonly accepted clearance requirements for large vessels are 2 to 3 feet minimum. The sum of the above factors indicates a 5-foot hull clearance is necessary for all vessels. Computation of tidal delays was predicated on the 5-foot clearance.

52. In order to provide for the greater lengths and widths of the larger tankers expected to carry future commerce, and to eliminate as far as possible hazardous navigational conditions attendant on narrow channels, the channel limits were revised wherever possible to provide greater width. Particular attention was directed to obtaining sufficient width at the bends for easement of vessel traffic.

53. The considered plan consists of: dredging the entire channel to a depth of 35 feet, widening the reach above the P. J. McArdle Bridge from 200 to 225 feet and widening the bend below the Chelsea Street Bridge from 200 to 250 feet. Channel adjustments in the upper reach include: widening the bend immediately above the Chelsea Street highway bridge from 300 to 430 feet and widening the next reach above from 200' to 300' to the next bend, relocating the next reach 50 feet southerly to avoid the berthing space at the adjoining Gulf Oil Corp. wharf and widening it from 200 to 250 feet. The plan also provides for a turning and maneuvering area about 800 feet wide (average) and 1,000 feet long at the upper end of the project. The basin area is necessary to allow for the maneuvering of loaded inbound vessels for the purpose of docking them and for the turning around of all outbound ships prior to proceeding down the river. Analysis of vessel traffic indicates the necessity for a 35-foot depth in this area. It is considered that the area within the limits of the considered improvement will suffice for the needs of navigation during the project life. Therefore the plan of improvement would include discontinuance of Federal interest in those areas of the waterway outside its limits.

54. Design of the turning basin was developed after consultation with shipping and towboat interests, together with terminal operators in the upper reach. All concerned agreed that the basin as designed, while not ideal, presented the most feasible solution of turning larger ships in the upper reach at this time. It was also stated that any constriction of the designed dimensions would hamper navigation of the waterway. In 1958 the Northeast Petroleum Corporation announced its intention of erecting a terminal and wharf which would abut the existing harbor line in the vicinity of the basin under consideration. The company was advised that relocation of existing harbor lines 200 feet northwesterly would probably be recommended in that area. However, due to the exigencies and economy of construction, plus the relative inability to forecast Federal improvement, the corporation decided to extend its wharf to the existing harbor line and completed construction in 1959. To provide for the designed turning basin it will be necessary to relocate the harbor line and wharf 200' feet northwesterly at an estimated cost of \$214,000.

#### SHORELINE CHANGES

55. The banks of the river are largely bulkheaded, with very little natural bank left along the shoreline. There is minor tidal flow. In view of these conditions, it is considered that the proposed improvement would have no appreciable effect on the present configuration of the shoreline.

## REQUIRED AIDS TO NAVIGATION

56. The U.S. Coast Guard has been consulted and has advised that no additional aids to navigation will be required.

### ESTIMATE OF FIRST COST

57. An estimate of first cost has been prepared for the considered plan of improvement. The estimate is divided into two components. One component includes widening the existing 30-foot channel together with provision of a 30-foot maneuvering basin to permit the passage of larger vessels with greater navigational ease. The second includes deepening the widened 30-foot channel and basin to 35 feet to eliminate or reduce tidal delays. Probings taken in 1947 and 1957 show ordinary materials, consisting of mud, sand, gravel and clay. Dredging quantities are in terms of place measurement and provide for dredging to the proposed project depth with a two-foot allowance for overdepth. Side slopes of 1 on 3 were used throughout. Prices are based on the use of bucket dredge with disposal at sea. The unit price is based on prices current in fiscal year 1960.

#### I. Federal

##### (1) Corps of Engineers

##### (a) 30-foot Widened Channel and Basin

Dredging 707,200 cubic yards of sand, mud, gravel and clay @ \$1.50	\$1,060,000
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Contingencies	160,000
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Engineering and Design	10,000
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Supervision and Administration	<u>100,000</u>
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\$1,330,000

##### (b) 35-foot Widened Channel and Basin

Dredging 826,000 cubic yards of mud, sand, gravel and clay @ \$1.50	\$1,239,000
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Contingencies	180,000
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Engineering and Design	4,000
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Supervision and Administration	<u>90,000</u>
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\$1,513,000

##### (c) Pre-Authorization Study

17,000

Total	\$2,860,000
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## II. Non-Federal

(1) Metropolitan District Commission Lowering Water Tunnel	\$1,000,000
(2) Metropolitan Transit Authority & N.Y.C. Railroad Lowering Cables	16,000
(3) Boston Gas Company Lowering Gas Siphon	910,000
(4) Relocation of Northeast Petroleum Corp. Wharf	214,000
	<u>\$2,140,000</u>

III. Total Federal and Non-Federal \$5,000,000

### ESTIMATES OF ANNUAL CHARGES

58. The estimated annual charges have been computed for an assumed 50-year anticipated life of the project at interest rates of 2.625%, Federal and 3.5 percent, local. The annual charges on improvement of the channel and maneuvering basin have been computed on the basis that the total cost of improvement of channel and basin will be incurred by the United States and the costs of required alteration to existing structures will be borne by local interests.

#### ESTIMATED ANNUAL CHARGES

##### I. Widening existing 30-foot channel and inclusion of a 30-foot maneuvering basin

###### 1. Federal Investment

(a) Construction (Corps of Engineers)	\$1,330,000
(b) Aids to Navigation (Coast Guard)	---
(c) Pre-Authorization Study	<u>17,000</u>

Total \$1,347,000

###### 2. Federal Annual Carrying Charges

(a) Interest (1,347,000 x 0.2625)	\$35,370
(b) Amortization (1,347,000 x .00989)	13,330
(c) Additional Maintenance	<u>2,500</u>

Total \$51,200

3.	Non-Federal Investment	\$214,000
4.	Non-Federal Carrying Charges	
	(a) Interest (214,000 x .035)	7,470
	(b) Amortization (214,000 x .00763)	<u>1,630</u>
	Total	\$9,100
5.	Total Annual Carrying Charges (30' Channel)	\$60,300
II.	Deepening Widened 30-Foot Channel and Basin	
1.	Federal Investment	
	(a) Construction (Corps of Engineers)	\$1,513,000
	(b) Aids to Navigation (Coast Guard)	<u>---</u>
	Total	\$1,513,000
2.	Federal Annual Carrying Charges	
	(a) Interest (1,513,000 x 0.02625)	\$39,725
	(b) Amortization (1,513 x .00989)	<u>14,975</u>
	(c) Additional Maintenance	<u>--</u>
	Total	\$54,700
3.	Non-Federal Investment	
	(a) Lowering Utilities	\$1,926,000
4.	Non-Federal Carrying Charges	
	(a) Interest (1,926,000 x .035)	\$67,400
	(b) Amortisation (1,926,000 x .00763)	<u>14,700</u>
	Total	\$82,100
5.	Total Carrying Charges	\$136,800
III.	Summary of Annual Charges	
1.	Federal	
	(a) 30-foot Widened Channel and Basin	\$51,200
	(b) 35-foot Widened Channel and Basin	<u>54,700</u>
	Total	\$105,900
2.	Non-Federal	
	(a) 30-foot Widened Channel and Basin	\$9,100
	(b) 35-foot Widened Channel and Basin	<u>82,100</u>
	Total	\$91,200
3.	Total Annual Carrying Charges	\$197,100

## BENEFITS

59. Evaluation of benefits to present and prospective commerce on Chelsea River has been derived from studies pertinent to widening the existing 30-foot channel, providing a turning and maneuvering basin at the upper end of the project, and deepening the waterway to reduce or eliminate tidal delays.

60. Benefits, which will accrue from the savings to prospective commerce in petroleum products, have been evaluated on the basis of the expected average annual increase over a 20-year period. Studies of the area indicate that commerce at that time will have reached its maximum probable development, considering such factors as available land area for future expansion of terminals, and the incapability of the waterway to handle efficiently any larger volume of commerce. For the 20-year period, the average yearly increase has been conservatively estimated to be 3 percent of present commerce or a total of 60 percent over the period. This rate is deemed reasonable and conservative, in view of past increases, which have totaled 1,000,000 tons over the last decade. Other governing factors include population growth, a constant increase in varied new uses of petroleum, and the anticipated establishment of new, and expansion of existing terminals. For the purpose of this report benefits computed for commerce in petroleum products include only that portion of such commerce delivered to Chelsea River in vessels drawing more than 30 feet. The annual benefits have been computed on the basis of reaching a maximum in 20 years. This maximum annual average benefit has been adjusted to average annual equivalent value.

61. In the upper reach above the Chelsea Street Bridge, petroleum products are presently delivered to the terminals in vessels no larger than T-2 tankers. Navigation of the waterway is very difficult for these vessels, and usually requires the assistance of two to four towboats per trip. Even with this assistance, extreme care is necessary to prevent groundings or accidents. Shipping interests claim that the T-2 tankers are the largest that can be used under present conditions, due to restricted maneuvering space, particularly at the bends and in the present turning basin. Examination of the present channel alignment indicates the justification of this claim. Benefits, therefore, have been evaluated for channel widening, wherever possible. These benefits are also considered to be attributable to provision of a larger turning basin, since the vessels will require turning prior to proceeding outbound. Since widening the existing 30-foot channel would enable the larger vessels to transit the waterway, subject to tidal delays, benefits have been computed separately for that portion of the project. Enlargement of the turning basin is also considered to be included in this category.

62. T-2 tankers presently navigating the river require the assistance of two or more towboats, dependent on their destination. In general, two towboats are used in the lower reach and three or four in the upper reach. Shippers claim a material saving in towboat costs per vessel trip in the event of channel widening. This saving would be effected by reducing the number of towboats per trip. Investigation of navigational requirements does not reveal any substantial saving in this respect, since it is considered that towboat assistance for larger tankers expected to use the waterway would be substantially the same as for T-2's. However, since channel widening will permit the use of the larger tankers, the anticipated annual average volume of petroleum can be carried in fewer vessel trips, thus lessening the number of towboats needed annually. The saving effected by reduction of towboat hire will result in a benefit attributable to 30-foot channel widening and 30-foot maneuvering basin.

63. As previously stated, the existing commerce is subject to tidal delays. Commercial interests claimed that navigation was possible only at high water slack during daylight hours. This claimed daylight restriction is considered to have been attributable to the former hazardous conditions prevailing at the railroad bridge. With the bridge removed and the clearance increased from 70 to 96 feet at that point, navigation will be possible during all periods of favorable tide and will not be restricted to slack daylight hours. Therefore benefits to be derived will be due to channel improvements only and exclusive of the effects of bridge clearance. The benefits will be derived from the use of larger ships which will be enabled to navigate the wider channel and more adequate turning basin. Benefits will also result from deepening the widened channel and basin by elimination or reduction of tidal delays.

#### COMPUTATION OF BENEFITS

64. Several oil interests have indicated that future deliveries of petroleum products will be in the "Jumbo T-2" type tankers. The dimensions of this type are 563 feet in length by 75 feet in beam, by 32 feet in draft, fully loaded. Cargo capacity for these vessels is about 21,400 short tons, compared with about 17,700 for the T-2's. Other oil interests have indicated that 26,500 to 32,000 deadweight ton vessels will be used. These types will begin to supplant the present T-2 and smaller tankers, immediately after improvement and will be used exclusively by the end of the 20-year period for which the commerce is expected to increase. Therefore benefits are computed on the basis that the maximum annual benefits will be realized in 20 years and continue thereafter. No benefits for channel widening or towboat assistance have been computed for the larger than T-2 tankers in the lower reach. These vessels can now navigate the lower reach with attendant tidal delays. In 1958 a total of 32 vessels larger than T-2's navigated the lower reach. Navigation interests advise

that although the larger ships can navigate the lower reach by exercise of extreme caution, it is not feasible in the upper reach. The major reasons for this claim lies in the vicinity of the Chelsea Street Bridge. Below the bridge the bend is narrow and abrupt. Widening of the bend, together with widening the reach downstream of it, will allow for aligning the longer vessels into position to transit the drawspan of the bridge.

65. The 1980 anticipated commerce will be delivered to upper Chelsea River in vessels with varying loads ranging from 21,000 to about 34,000 short tons. It is considered that the 32,000 dwt tankers with dimensions of 650 feet in length, 90 feet in width and 34-foot draft will be about the largest to be used at that time in view of the Chelsea Street Bridge width of 96 feet. In order to arrive at an average vessel use of the river it is estimated that one-half of the commerce would be carried in the smaller 20,000 dwt vessels and the remainder in the 32,000 dwt vessels. The prospective commerce of 5,240,000 tons on the upper river (see Par 67) would require 202 trips of this combination of vessels. To carry the same amount of commerce in 16,500 tons, T-2 vessels would require 296 vessel-trips. Thus 94 less vessel trips would be required with resultant towboat savings. Average towboat hire, as furnished by local interests is \$1,000 per trip. For the 94 trips not required, the savings would be  $94 \times \$1,000$  or \$94,000, a benefit attributable to the widened channel and basin. The annual average equivalent of these benefits based on reaching a maximum in 20 years is estimated to be \$66,900.

66. The average cost of transporting petroleum products to Chelsea River in T-2 tankers has been determined to be \$0.11 per ton higher than 20,000 dwt tankers and \$0.46 higher than 32,000 ton vessels. As stated previously, the savings to be derived from use of the larger vessels are attributable to the upper reach only, since navigation of the lower reach is presently possible for the larger vessels. In the upper reach the prospective annual commerce (Par 67) is 5,240,000 tons. Of this commerce one-half or 2,620,000 tons would be delivered in 20,000 dwt vessels and the remainder in 32,000 dwt vessels. The savings for that portion delivered in 20,000 dwt vessels would be  $2,620,000 \times \$0.11 = \$288,200$ . For the 32,000 dwt vessels the corresponding savings would be  $2,620,000 \times \$0.46$ , or \$1,205,200. The sum of the two, \$1,493,400, reduced to its annual average equivalent at 2.625 percent becomes  $\$1,493,400 \times .71161$ , or \$1,062,700, an annual benefit. To allow for benefits to the shipping ports, one-half, or \$531,350 has been assigned to Chelsea River.

67. Tidal delays vary for vessels of different draft and vary also according to time necessary to transit the waterway prior to

docking. For the lower reach, it was found that the average transit time amounted to 3/4 hour and for the upper reach 1 1/4 hours. These factors were used in computation of average tidal delays from the mean tide curve of Chelsea River. The average tidal delays in Chelsea River were computed for each type of vessel expected to use the waterway and varied from 3:25 hours for 20,000 dwt tankers to 5.0 hours for 32,000-ton tankers in the lower reach. The delays to vessels expected to use the upper reach varied from 3.7 to 5.8 hours. The benefits for elimination or reduction of tidal delays were computed separately for the lower and upper river and are shown in Table III of this report. The annual average equivalent of these benefits based on reaching a maximum in 20 years and continuing unchanged thereafter during the anticipated life of the project amounts to \$184,000.

#### SUMMARY OF BENEFITS

Savings in transportation costs attributable to widened 30-foot channel and maneuvering basin	\$531,350
Savings in towboat assistance, by elimination of 94 vessel trips, attributable to widened 30-foot channel and maneuvering basin.	66,900
Savings attributable to reduction or elimination of tidal delays (35-foot channel and basin).	<u>184,000</u>
Total Benefits	\$782,250

TABLE III

Savings from Reduction in Tidal Delays  
35-Foot Channel  
 (Annual Benefits, Based on Reaching Maximum in 20 Yrs)

Location	Oil Receipts in Deep Draft Tankers (Short Tons)		Vessel Trips			Average Tidal Delays		Delays Eliminated per Trip(Hrs)	Total Delays Eliminated (1980)	Hourly Operating Cost \$	Total Savings \$	Total
	Present (1953)	Future (1980)	1980	Type	Draft	30' Channel	35' Channel					
Lower Reach (Below Chelsea St. Bridge)	1,349,583	2,800,000 <sup>(1)</sup>	67	20,000 dwt	32	3.25	0.6	2.65	177.6	228	40,490	82,820
			41	32,000 dwt	34	5.0	1.5	3.50	143.5	295	42,330	
			125	20,000 dwt	32	3.7	0.8	2.9	362.5	228	82,650	
Upper Reach (Above Chelsea St. Bridge)	2,874,679	5,240,000 <sup>(2)</sup>	77	32,000 dwt	34	5.8	1.7	4.1	315.7	295	93,130	175,780
Total	4,224,262	8,040,000	310								Total	258,600

Annual Average Equivalent  $\$258,600 \times 0.71161 = \$184,000$

(1) Includes 640,000 tons estimated for terminal enlarged in lower river in 1959.

(2) Includes 640,000 tons estimated for terminal placed in operation in upper river in 1959.

68. The benefits computed above are based on the fact that a sizeable portion of petroleum products, delivered in larger than T-2 tankers, will be carried in 20,000 dwt tankers. Consideration of the extent of their use entailed advice from shippers, and the American Merchant Marine Institute, together with construction reports of various shipbuilders. It is considered that the use of 20,000 dwt tankers will discontinue sometime during the anticipated life of the project and larger vessels will be substituted for them. This estimate reflects such factors as recent trends toward larger vessels, in tanker construction, the efforts of shippers to reduce transportation costs by using these larger ships, and the life-expectancy of the present fleet of such tankers. However, benefits for the greater use of larger vessels have not been computed since it is considered that the size of the vessels and the extent of their use on this waterway cannot be accurately determined at this time. For this reason benefits as computed are relatively lower than the total benefits possible of derivation by improvement of the waterway but are of sufficient magnitude to justify improvement for the needs of present and anticipated commerce.

69. In addition to the foregoing evaluated benefits, there are intangible benefits which are not readily susceptible of monetary evaluation. These benefits would result from greater ease and facility of navigation and a reduction of the rate of probability of accidents in a widened and deepened channel and turning basin. These benefits are believed to be substantial.

#### COMPARISON OF BENEFITS TO COST

70. The following table presents a comparison of benefits to cost for the components of the considered plan of improvement together with the overall improvement.

	<u>Annual Benefits</u>	<u>Annual Costs</u>	<u>Benefit- Cost Ratio</u>
Widening 30-foot channel and basin	\$598,250	\$60,300	9.9
Deepening 30-foot widened channel and basin to 35 feet	184,000	136,800	1.3
Combined project	782,250	197,100	4.0



## PROPOSED LOCAL COOPERATION

71. Since the benefits to be derived are considered to be general in character no local cash contribution toward the first cost of construction should be required. However, the cost of altering structures impeding the full realization of the recommended improvement should be borne by local interests. In addition, local interests should deepen their berths and approach channels commensurate with project depth. The area immediately adjoining the waterway is of a generally developed metropolitan character with no adjacent spoil disposal area available for filling. Distant areas would require use of booster pumping, which would entail additional costs of construction. In view of this factor, it is considered that it would be impracticable to require that local interests furnish spoil disposal areas. Local interests should be required to hold and save the United States free from damage that may result from the construction works and provide without cost to the United States, all lands, easements and rights of way necessary for construction of the project and maintenance of aids to navigation, upon request of the Chief of Engineers. The owners of structures which would impede full realization of the proposed project have submitted estimates of costs for the necessary alterations. They are opposed to alteration but are cognizant of the fact that, under the terms of their occupancy, alterations will be required in order that the entire needs of navigation may be realized. The Massachusetts Division of Waterways has provided reasonable assurances that the remaining requirements of local cooperation will be met.

## COORDINATION WITH OTHER AGENCIES

72. All Federal, State and local government agencies were notified of the public hearing held at the United States Post Office Building on June 26, 1946. Subsequently, discussions were held with representatives of the City of Boston, representatives of the Maritime Association of Boston, the American Merchant Marine Institute and various shipping interests. The U. S. Fish and Wildlife Service, and their parallel State agencies, were consulted on the study and its conclusions. The U. S. Bureau of Public Roads was similarly consulted.

## DISCUSSION

73. Chelsea River, at the head of the 35-foot Boston Harbor channel, is a short chiefly tidal waterway. Its navigable length is about 2 miles. The waterfront is fairly well developed with 13 oil terminals located on its shores. However, there are a few areas available for expansion, including a few unused wharf properties. Local interests claim that further commercial development will result from improvement of the waterway. As justification of this claim, it was pointed out that 2 new terminals were established and 3 existing terminals were expanded in the last 10 years, adding about 1,500,000 barrels of storage capacity.

74. In 1958 commerce on the waterway amounted to 5,390,931 tons of which 5,373,000 tons were petroleum products. Of this commerce 4,927,000 tons were receipts of petroleum, which is about

39 percent of all such products delivered to the port of Boston. These products are received into the terminals then transhipped by rail, motor truck and barge to various points in New England.

75. The 30-foot existing project was completed in 1939, except for a small portion between the piers of the Chelsea Street Bridge. Dredging of this portion was accomplished in 1946. The 30-foot channel was designed for tankers of pre-war class, having loaded drafts ranging from 25 to 29 feet. During World War II and immediately afterward, T-2 tankers with registered drafts of slightly over 30 feet began to replace the smaller vessels and in recent years, have been used almost exclusively. In 1956 one company operating in the lower reach introduced large tankers of the 26,500 dead weight ton class and in recent years has used some 32,000 dead weight ton vessels.

76. Navigation of the waterway is hazardous for both T-2 and larger tankers, requiring the assistance of two to four towboats each trip, depending on their destinations. Navigation of the tankers is also subject to average tidal delays of 3.25 to 5 hours. In view of these navigation conditions and the trend in tanker construction toward larger vessels, local interests claim that the present channel design is inadequate for the present commerce and not feasible for the larger tankers presently being introduced into general coastwise use. This claim is considered reasonable as investigation of it revealed that several oil companies using the river have recently converted T-2 tankers into larger size vessels, having 25 percent more cargo-carrying capacity. In the rebuilding, lengths and widths have been increased proportionally, making navigation of them extremely difficult in the lower reach and too hazardous in the upper reach of the waterway. Other oil companies are contemplating the use of larger vessels, for which the present channel is inadequate. Dimensions of the larger ships, considered in this report, range from 575 to 650 feet in length, 75 to 90 feet in width, and 32 to 34 feet in draft. Design of the proposed improvement is based on consideration of these dimensions. Design of the channel includes widening of the channel below the Chelsea Street Bridge by 25 feet in the lower reach and by 50 feet at the bend immediately below Chelsea Street Bridge. The reaches above the bridge together with the bends are also proposed to be widened to enable the larger vessels to navigate this portion of the waterway. This widening would require relocation of the harbor line on the left bank of the river immediately upstream of the Chelsea Street Bridge.

77. In the upper reaches, the existing 200-foot channel width is insufficient for the turning of large tankers prior to proceeding outbound. This condition required that vessels be towed out stern first. Access to the wharves at the upper end was also very difficult of accomplishment. To correct this situation local interests in 1934

dredged a turning basin 25 feet deep near the upper end of the channel. The present controlling depth of the basin is 25 feet. Inclusion of this basin in the existing project plus widening and deepening it will result in benefits for the terminals in the upper part of the river by making it possible for the larger tankers to gain access to the wharves and to turn around to proceed outbound under power.

78. Provision of the turning basin in the upper reach will require relocation of the existing harbor lines in that area. It will also entail relocation of an existing wharf for a distance of 200 feet shoreward. There are also several utilities in the vicinity of the Chelsea Street Bridge which will require alteration. These utilities are: a water supply tunnel, owned by the Metropolitan District Commission, a gas siphon owned by the Boston Consolidated Gas Company, five cables, four owned by the Metropolitan Transit Authority and one by the New York Central Railroad. The estimated cost of this local construction is \$2,140,000.

79. Commerce on the river has increased steadily since the inception of the existing project. In the 10-year period from 1949 to 1958, annual commerce has increased by over a million tons. As the area adjoining the waterway is considered the major oil center of the port of Boston, having 50 percent of its oil storage capacity, commerce in petroleum products is expected to increase substantially in the event of improvement. This consideration is based on past records which show establishment of 2 new terminals and expansion of 3 existing terminals in less than 10 years in what is considered an inadequate waterway. This construction added over 1,500,000 barrels of storage capacity to the waterway. The anticipated increase was conservatively estimated to be 3 percent per year over present commerce, reaching a maximum of 60 percent in 20 years.

80. It is considered that the larger vessels will begin to supplant the present T-2's immediately after improvement and will be used exclusively after the 20-year period in which commerce is estimated to increase. The benefits estimated to accrue at that time have been adjusted for their annual average equivalent value over the 50-year anticipated life of the project. Benefits to be derived from improvement of the waterway are considered to result from savings in transportation costs, reduction in tidal delays and reduction in annual towboat hire. The savings in transportation costs will be made possible by the ability to use larger ships carrying petroleum products on the upper reaches of the waterway. It is not now feasible to navigate these vessels in the present constricted channel in the upper reaches. Benefits thus derived are estimated to total \$1,493,400 annually in 20 years, and have an annual average equivalent value of \$1,062,700. To allow for benefits to the shipping ports the benefits have been reduced by one-half or \$531,350. Towboat assistance is presently necessary for vessels navigating the waterway. This assistance will not decrease for individual sailings on the river. But since the total commerce

can be carried in fewer vessel trips by use of larger vessels, the annual costs of towboat assistance will decrease correspondingly. Adjusted benefits from this source total \$66,900. Reduction in tidal delays over a deepened channel have also been estimated. Adjusted benefits from this source are estimated to total \$184,000 annually.

81. The cost of the considered improvement is \$5,000,000 including local costs of \$2,140,000 for alteration of structures, and including \$17,000 for preauthorization studies. No additional aids to navigation would be required. Annual charges have been computed to be \$197,100. Comparison of the total annual benefits of \$782,250 to the annual charges of \$197,100 results in a benefit-cost ratio of 4.0 indicating decisive justification of improvement.

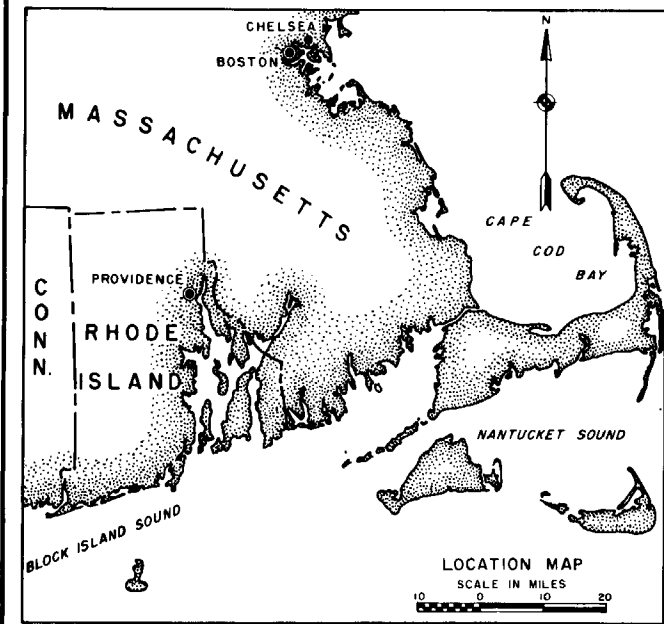
### CONCLUSION

82. In view of the foregoing the Division Engineer concludes that the existing 30-foot deep and 200-foot wide channel in Chelsea River is inadequate for the T-2 tankers delivering the present commerce in petroleum products and not feasible for the larger vessels expected to carry future commerce. He believes that the existing project of Boston Harbor should be modified to provide adequate navigation facilities for these vessels in Chelsea River. He considers the proper modification should consist of widening the channel wherever possible, particularly at the bends, the inclusion of a maneuvering and turning basin at the upper end of the project which will require relocation of a pier and harbor lines in that area, and deepening the widened channel and basin to 35 feet at mean low water. He further considers that those parts of the existing 30- and 8.4-ft. channels, which lie outside the limits of the proposed improvement, no longer serve any useful general navigational purpose and should be eliminated from the existing Federal project. The modification can be accomplished at an estimated Federal cost of \$2,860,000 including preauthorization study costs of \$17,000, plus local costs of \$2,140,000 for necessary alteration of structures. The ratio of 4.0 to 1 for evaluated benefits to annual charges indicates decisive economic justification of the project. Inasmuch as local interests in the past have expended considerable sums in the development of the waterway and as the benefits to be obtained are general in nature, it is considered that local cooperation in the form of a cash contribution to the cost of the improvement should not be required.

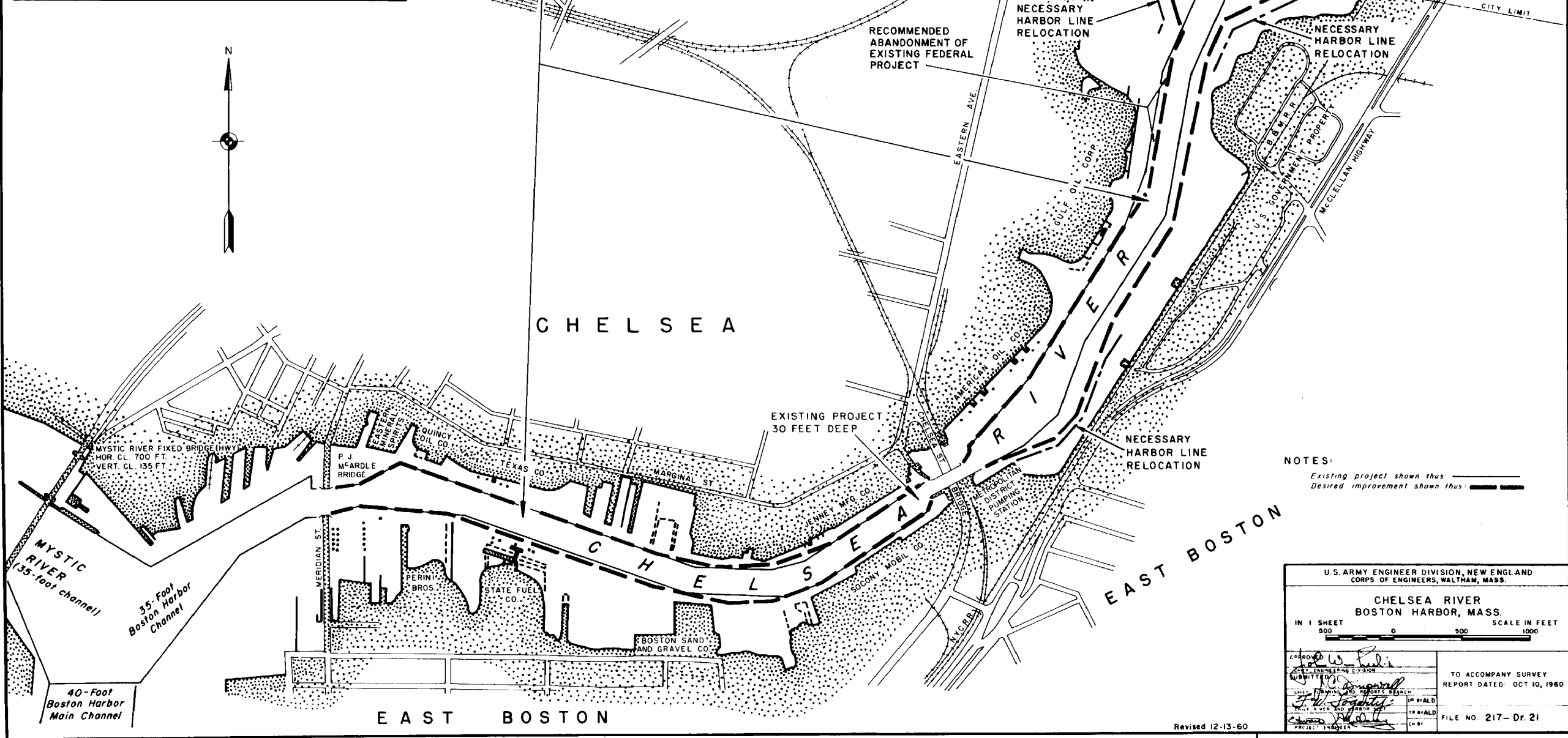
## RECOMMENDATION

83. The Division Engineer recommends that the existing project for Boston Harbor be modified to provide for: a channel 35 feet deep, generally 225 to 250 feet wide below Chelsea Street Bridge, a channel 35 feet deep with widths varying from 250 feet to 430 feet wide above Chelsea Street Bridge, and for inclusion of a turning and maneuvering basin of 800 feet average width and 1,000 feet average length and of the same depth as the channel, all at an estimated total cost of \$5,000,000 including local costs of \$2,140,000 without additional aids to navigation being required, subject to the condition that no construction work be accomplished until local interests agree to: (1) hold and save the United States free from damages resulting from construction of the improvement; (2) obtain all lands, easements, and rights-of-way necessary for construction of the project and maintenance of navigation aids, upon request of the Chief of Engineers; and (3) accomplish necessary alterations to utilities and docks, including approach channels and berths to a depth commensurate with project depth. The total cost to the United States for this project modification is estimated to be \$2,843,000 for construction and \$2,500 annually for maintenance, in addition to that now required. The Division Engineer further recommends that those areas of the 30- and 8.4-foot channels lying in the waterway outside the presently recommended 35-foot project be excluded from the Federal navigation project for Chelsea River (Boston Harbor) at this time.

KARL F. EKLUND  
Colonel, Corps of Engineers  
Acting Division Engineer



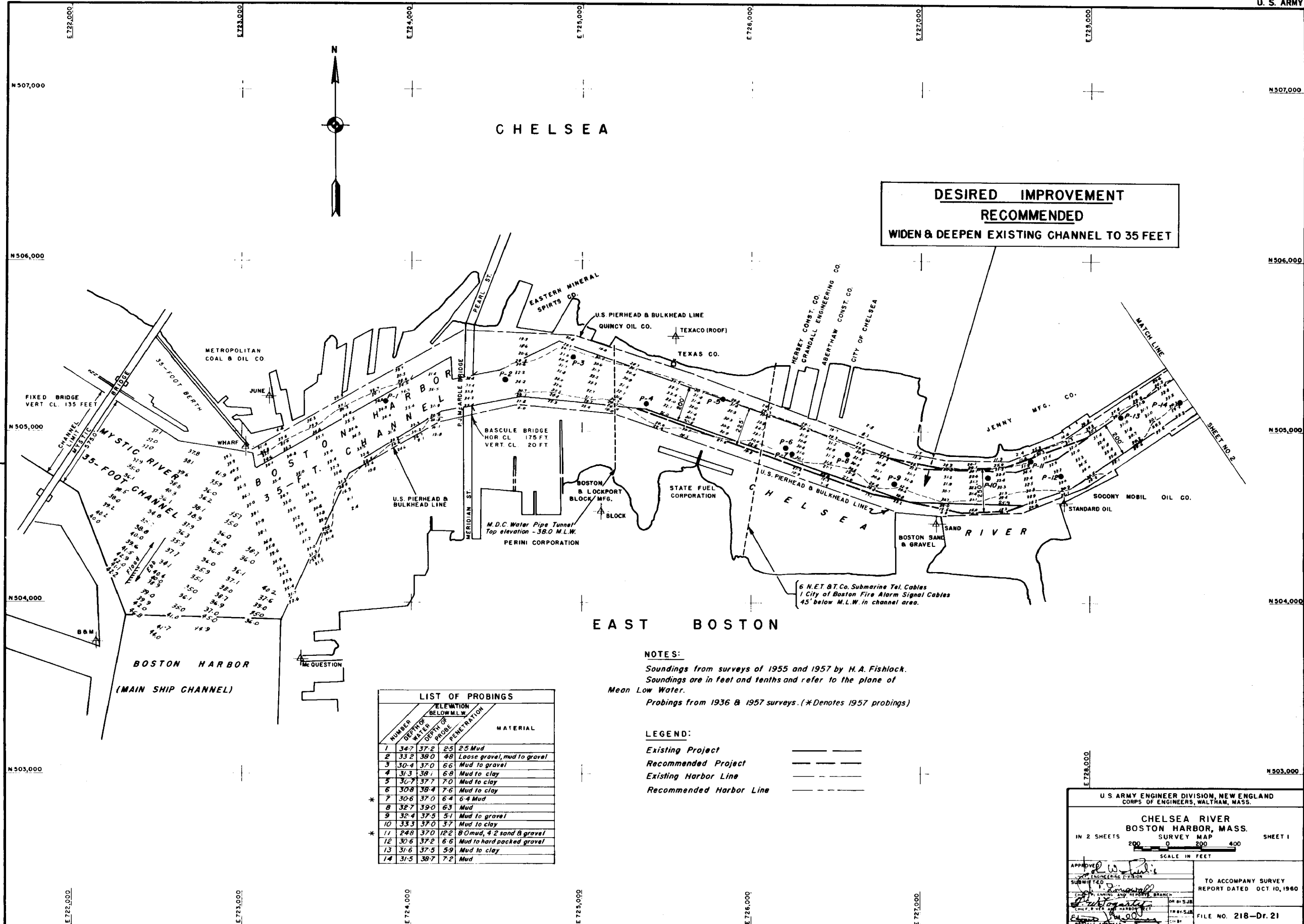
**DESIRED IMPROVEMENT  
RECOMMENDED**  
CHANNEL 35 FEET DEEP  
TURNING BASIN 35 FEET DEEP



NOTES:  
Existing project shown thus ———  
Desired improvement shown thus: - - - -

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS, WALTHAM, MASS.	
CHELSEA RIVER BOSTON HARBOR, MASS.	
IN 1 SHEET 900	SCALE IN FEET 0 500 1000
TO ACCOMPANY SURVEY REPORT DATED OCT 10, 1960	
FILE NO. 217-Dr. 21	

Revised 12-13-60



LIST OF PROBINGS				
NUMBER	DEPTH WATER	DEPTH OF PROBE	ELEVATION BELOW M.L.W.	
			PROBE	PENETRATION
1	34.7	37.2	25	25 Mud
2	33.2	38.0	48	Loose gravel, mud to gravel
3	30.4	37.0	66	Mud to gravel
4	31.3	38.1	68	Mud to clay
5	30.7	37.7	70	Mud to clay
6	30.8	38.4	76	Mud to clay
* 7	30.6	37.0	64	6.4 Mud
8	32.7	39.0	63	Mud
9	32.4	37.5	51	Mud to gravel
10	33.3	37.0	37	Mud to clay
* 11	24.8	37.0	122	8.0 mud, 4.2 sand & gravel
12	30.6	37.2	66	Mud to hard packed gravel
13	31.6	37.5	59	Mud to clay
14	31.5	38.7	72	Mud

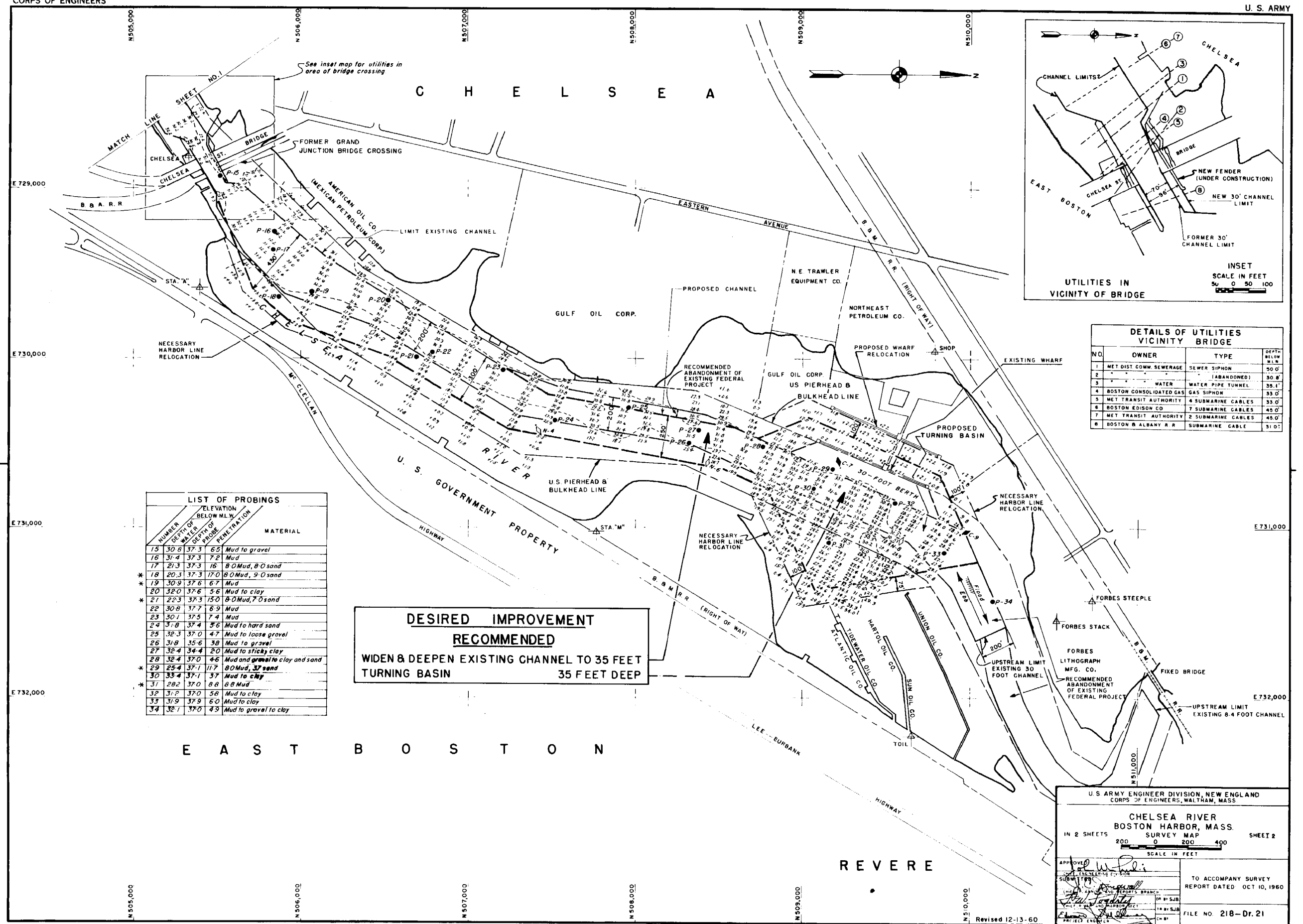
NOTES:

Soundings from surveys of 1955 and 1957 by H. A. Fishlock.  
Soundings are in feet and tenths and refer to the plane of  
Mean Low Water.  
Probing from 1936 & 1957 surveys. (\* Denotes 1957 probings)

LEGEND:

Existing Project \_\_\_\_\_  
Recommended Project \_\_\_\_\_  
Existing Harbor Line \_\_\_\_\_  
Recommended Harbor Line \_\_\_\_\_

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS, WALTHAM, MASS.	
CHELSEA RIVER BOSTON HARBOR, MASS.	
IN 2 SHEETS	SHEET 1
SCALE IN FEET 0 200 400	
APPROVED SUBMITTED PROJECT ENGINEER	TO ACCOMPANY SURVEY REPORT DATED OCT 10, 1960 FILE NO. 218-Dr. 21





SURVEY OF CHELSEA RIVER, MASSACHUSETTS  
APPENDIX A

ESTIMATES OF FIRST COST

1. Estimates of first costs of the recommended improvement are detailed below. Federal construction consists of widening the present channel throughout the upper half of the river, widening the bend below the Chelsea Street Bridge and the reach below it in the lower half of the river, and provision of a turning and maneuvering basin at the upper end of the project. Deepening the entire project to 35 feet is also recommended. Local interests will be required to lower a water supply tunnel, a gas siphon and 3 cables in the vicinity of the Chelsea Street Bridge and relocate a wharf at the upper end of the project. The U. S. Coast Guard has advised that no additional aids to navigation will be required.

2. Probings made during the study, and previously, indicate that the materials to be removed consist of mud, sand, clay and gravel. It is not anticipated that ledge rock will be encountered. Dredging quantities are in terms of in-place measurement and include an allowance of 2 feet for overdepth. Side slopes of 1 vertical on 3 horizontal have been used. Dredging prices are based on price levels prevalent in July 1960.

3. Estimates of costs are detailed below.

PROJECT COST ESTIMATES (Thousands of Dollars)			Cost Estimates (\$1,000) (July 1960)
<u>Cost Account Number</u>	<u>Item</u>		
09	<u>Channels</u> , 30' and 35' channels plus 35' turning and maneuvering basin dredging 1,533,000 cubic yards of mud, sand, clay & gravel @ \$1.72*		\$2,639.0
29	Preauthorization Studies		17.0
30	Engineering and Design		14.0
31	Supervision and Administration		<u>190.0</u>
	Total Cost (Corps of Engineers)		\$2,860.0
	<u>Total Non-Federal Costs</u>		
	Lowering water supply tunnel (MDC)		1,000.0
	Lowering cables (MTA & NYC RR)		16.0
	Lowering gas siphon (Boston Gas)		910.0
	Relocation of wharf (N.E. Petroleum Co.)		<u>214.0</u>
			\$2,140.0
	Total Federal and required non-Federal costs		\$5,000.0

SURVEY OF CHELSEA RIVER, MASSACHUSETTS  
APPENDIX B  
U. S. FISH AND WILDLIFE REPORT

By letter of 17 February 1960, the Regional Director of the United States Fish and Wildlife Service, Department of the Interior was requested to comment on the effects of the proposed improvement on fish and wild life. It was explained that it was planned to accomplish the work by bucket dredge, with spoil being made at sea. The full report of the Fish and Wildlife Service is reproduced on the following page.



ADDRESS ONLY THE  
REGIONAL DIRECTOR

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
FISH AND WILDLIFE SERVICE  
BUREAU OF SPORT FISHERIES AND WILDLIFE  
59 TEMPLE PLACE  
BOSTON, MASSACHUSETTS

NORTHEAST REGION  
(REGION 5)  
MAINE  
NEW HAMPSHIRE  
NEW YORK  
VERMONT  
PENNSYLVANIA  
MASSACHUSETTS  
NEW JERSEY  
RHODE ISLAND  
DELAWARE  
CONNECTICUT  
WEST VIRGINIA

February 23, 1960

Division Engineer  
New England Division  
U.S. Corps of Engineers  
424 Trapelo Road  
Waltham 54, Mass.

Dear Sir:

Reference is made to your letter dated 17 February 1960 concerning current navigation study of Chelsea River, Massachusetts. The proposed plan of improvement would include widening and deepening the existing channel to 35 feet and providing a turning basin of that same depth.

We understand that it is proposed to dump the dredged materials in offshore areas. We offer no objections or other comments concerning proposed plan of improvement.

Sincerely yours,

M. A. Marston, Chief  
Division of Technical Services

SURVEY OF CHELSEA RIVER

APPENDIX C

CITY OF BOSTON

PUBLIC WORKS DEPARTMENT



JAMES W. HALEY  
COMMISSIONER  
TELEPHONE LA 3-5100  
EXTS. 501-502

511 City Hall Annex  
BOSTON 8, MASS.

February 17, 1961

To: Corps of Engineers, U.S. Army  
Office of the Division Engineer  
New England Division  
424 Trapelo Road  
Waltham 54, Mass.

Attention: Mr. Karl F. Eklund  
Deputy Division Engineer

Re: Chelsea St. Bridge  
Dredging of Channelway.

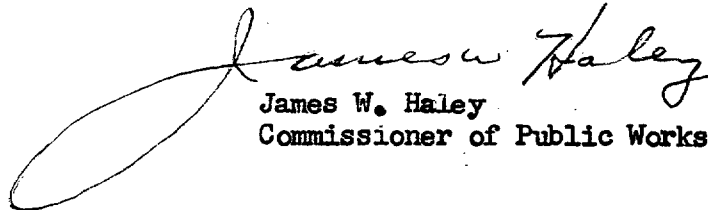
Gentlemen:

This is in reference to your letter of February 13, 1961 requesting concurrence of this department on your proposal to deepen the subject waterway to 35 ft. for a width of 85 ft. rather than a restricted width of 75 ft., as requested recently in your letter of December 19, 1960.

It is now agreed that the square bottom type of vessel expected to use the improved waterway precludes restricting the bottom width to 75 ft.

Therefore, this department hereby concurs with the proposed 85 ft. width of channel.

Very truly yours,



James W. Haley  
Commissioner of Public Works

JWH/JJM/jfm

R/2/61

## Chelsea River, Boston Harbor, Massachusetts

Information Called for by Senate Resolution 148,  
85th Congress. Adopted 28 January 1958.

1. Navigation Problems. - Chelsea River is a short tidal river situated at the head of Boston Harbor. It has a navigable length of 2.2 miles. As part of the Boston Harbor project, a channel generally 200 feet wide and 30 feet deep has been provided. Almost all of the navigable use of waterways is limited to tankers delivering petroleum products to the 13 oil terminals located along its shores. The mean range of tide is 9.6 feet.

2. The chief difficulties attendant on navigation are insufficient depth for the existing traffic and insufficient depth and width for larger tankers presently engaged in coastwise petroleum commerce. In the lower half of the river tankers with cargo-carrying capacities ranging from 17,000 tons to 34,000 tons now use the waterway. These vessels are presently subject to tidal delays averaging 2.6 to 5.8 hours per trip. In the upper half of the river, the present traffic is limited to vessels of 17,000 tons capacity. Larger vessels cannot use this portion of the river as there is insufficient width at the bends to accommodate the greater length of these vessels.

3. Improvement Considered and Recommended. - In the lower half of the river local interests desired deepening the river to eliminate or reduce tidal delays to which vessels drawing in excess of 30 feet are now subject. A depth of 35 feet was considered to be the minimum depth that would alleviate tidal delays in that area. In the upper reach there are several abrupt bends in the present channel. Navigation of T-2 tankers of 17,000 tons cargo carrying capacity is very hazardous and not feasible for larger tankers within present channel limits. At the upper end of this reach there is a turning basin dredged by private interests. Deepening and widening of this basin was requested by local interests. The basin was claimed necessary for maneuvering loaded vessels to the wharves in the upper end and turning unloaded vessels to enable them to proceed outbound bow first. Studies of various depths and widths of channels were made. It was found that a 35-foot deep channel would be the most feasible and economical depth that could be economically justified. It was found also that widening the channel in the upper part of the river and the first turn above the Chelsea Street Bridge would allow sufficient room for vessels of 34,000 tons capacity. The turning basin at the upper end would allow for maneuvering vessels and turning them for the purpose of outbound passage. Widening of the channel and provision of a turning basin will require relocation of existing harbor lines on the left river bank immediately upstream of the Chelsea Street Bridge, and also in the vicinity of the recommended turning basin. The relocation of these harbor lines will be necessary.

4. To attain full dimensions of the recommended project, it may be necessary to alter a water pipe tunnel, the top of which is now 0.14 feet below the proposed grade of the channel. It will be necessary to lower a gas siphon lying above the proposed grade, 5 cables lying on the present channel bottom, and to relocate a wharf lying within the limits of the proposed turning basin. The costs of such construction have been estimated and are considered entirely local in nature. The recommended improvements were found to be the maximum improvements economically justifiable at this time.

5. Estimated first costs, annual charges, and annual benefits, are based on July 1960 price levels, a 50-year anticipated project life, and interest rates of  $2 \frac{5}{8}$  percent Federal and  $3 \frac{1}{2}$  percent local. The costs, charges, and benefits are summarized below:

a. Estimated First Costs of Construction

Federal	\$2,843,000*
Non-Federal	<u>2,140,000</u>
Total First Cost of Construction	\$4,983,000

\* Excluding preauthorization study costs of \$17,000

<u>b. Estimated Annual Charges</u>	<u>Federal</u>	<u>Non-Federal</u>	<u>Total</u>
Interest and Amortization	\$103,400	\$91,200	\$194,600
Additional Annual Maintenance	<u>2,500</u>	<u>-----</u>	<u>2,500</u>
Total	\$105,900	\$91,200	\$197,100

c. Estimated Annual Benefits

	<u>General</u>
Reduction in Annual Towboat Costs	\$66,900
Savings in Transportation Costs	531,350
Reduction of Tidal Delays	<u>184,000</u>
Total Estimated Annual Benefits	\$782,250

d. Benefit-Cost Ratio = 4.0

6. During the course of the study various alternative plans of improvement were studied. These plans included studies of costs of various pipeline routes from the main harbor area to the existing terminals on the waterway. In all pipeline studies it was found that the costs of such plans far exceeded the cost of the recommended navigational improvement. In addition, other factors affecting the practicability of pipeline distribution to the many terminals on the river were considered, including such factors as individual lines to each terminal, real estate acquisition, refurbishing of wharves and all of the various increments incidental to establishment of a main central receiving terminal.

7. Apportionment of Costs and Local Cooperation. - In view of the benefits to be realized, which are entirely general in character, the total cost of construction, exclusive of alteration to local structures, should be borne by the United States. Authorization of the project should be subject to the requirements that local interests:

(a) Provide without cost to the United States, all lands, easements, and rights-of-way necessary for construction and subsequent maintenance of the project,

(b) Hold and save the United States free from damages that may result from construction and subsequent maintenance of the project,

(c) Alter the existing structures that would deter construction of the project to its full recommended dimensions.

8. Discussion. - Local interests have been notified of the extent of improvement, have approved the proposed plan of improvement and have given reasonable assurances that the indicated requirements of local cooperation will be met. The recommended plan of improvement provides the most feasible and economical method of meeting the current and anticipated needs of navigation on the waterway. Analysis of the project on the basis of an economic life of 100 years would increase the benefit-cost ratio from 4.0 to 4.9. The project is considered justifiable on the basis of studies in the report and criteria on similar navigation projects. Proposed local cooperation is in concordance with similar navigation projects.